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PREFABRICATION PROGRAM TO CUT BUILDING COSTS IN HUNGARY

by Rezso Ocsvar

There are various ways in which construction costs may be reduced. One of the most efficient ways is by prefabrication, especially of concrete elements.

Prefabrication shortens the duration of the building process, thereby reducing costs. Nevertheless, there still is a general dislike toward this method, particularly in the planning phase of subsurface construction. If the benefits of prefabrication are to be realized, this conservatism must be overcome.

In the spring of 1950, the Economic Council authorized a credit of 45 million forints for the financing of enterprises making prefabricated products for subsurface construction, and prefabricated elements manufactured by these enterprises amounted to 9.5 million forints by 1 September 1950. However, this figure represents only 4 percent of all building products.

In the field of prestressed concrete structures we are very much behind other nations, although the experimental stage has been passed.

Subsurface prefabrication may be broken down into five large groups:

1. Road construction
2. Railroad construction
3. Sewage construction
4. Bridge construction
5. Reinforced concrete structures

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The purpose of this article is to point out the past and present deficiencies and results, and the direction to be followed. In addition, we propose to fight prevalent conservatism in the field of prefabrication.

Prefabrication in Road Construction

Prefabrication in road construction is not an unknown concept. Let us think of the manufacture of guardrails, curb stones, border stones, etc. These cannot be called prefabricated in the modern sense because they were made according to different plans and local customs.

At present, the chief task is to develop standardized prefabricated elements to be used on a nation-wide scale. Some success has been achieved, but we are still at a stage where, for instance, guardrail types vary from county to county.

There is a wide field for standardization in road building. Reinforced concrete guardrails and guardrail posts are in this category, together with curbstones, signal posts, milestones, gutter elements, etc.

The problem of technique is going to be solved eventually. Round bars are being cut and installed in quantity. The laying of the concrete is accomplished almost exclusively with shakers or by the aid of vibrators. Great care is taken to use the right gravel composition and water-cement mixtures to insure optimum density.

Prefabrication is seasonal at present, contrary to the plan to eliminate the seasonal character of subsurface work. It is especially in the field of road construction that conversion has to be effected to wintertime prefabrication, and it is desirable to establish prefabricating plants which are mobile, not stationary. The necessary quantities of concrete or reinforced concrete may be prefabricated during winter in mobile barracks, using mobile equipment, close to the basic materials. Thus, material transportation costs may be reduced substantially.

Because prefabrication is to take place in mobile plants, insulated, portable barracks with heating equipment are needed. The most important thing, however, is complete conversion from wooden to steel molds. This has the great advantage that the molded surface is smoother and more wear-resistant and also reduces the cost of production. Wood is scarce in Hungary, and it is essential to convert to steel which may be used may times.

Since bitumen has to be imported, its use in the construction of sidewalks is to be eliminated. The sidewalk may be made of portland cement, rather than of bituminous materials.

The same principle may be applied in the prefabrication of road coverings. The method used chiefly in Poland may be adopted. This involves the prefabrication of a protecting layer, consisting of quarry stones, set in concrete. The layer is 15 centimeters thick, and the stones are hexagonal with a 40-centimeter diameter. This method has many advantages. Prefabrication does not depend on the seasons and the material is easy to store and to transport. Moreover, road-building by this process does not require skilled labor.

This type of layer, which is still in the experimental stage in Hungary, also permits the utilization of irregular smaller stones.

At present, road maintenance and construction enterprises are engaged in prefabrication in the fields mentioned above.

Prefabrication in Railroad Construction

Prefabrication in railroad construction, as in the case of viaducts, is in its elementary stages.

The most important part of prefabrication in railroad construction is the manufacture of reinforced concrete railroad ties. In this field, Hungary is among the leading nations of the world. There are sections where reinforced concrete railroad ties have been in use for 30 years and still carry the traffic well.

These ties differ from their foreign counterparts considerably, and production methods have been perfected to such an extent that it will be possible to increase production from 200,000 to 500,000 units per year during the course of the Five-Year Plan.

With the development of new methods, technicians have converted from ordinary to prestressed concrete railroad ties. This has the advantage of reducing the quantity of iron per cubic meter and the disadvantage of requiring, for prestressing, certain steel cables which have to be imported. For this reason, the question has to be examined from the point of view of foreign exchange.

The use of reinforced concrete ties is undoubtedly disadvantageous from the point of view of electrification. However, economy in Hungary's wood supply requires increased use of reinforced concrete ties, especially because the Five-Year Plan calls for the development of railroads. It is common knowledge that railroad-tie requirements average one million per year.

Attention should be paid also to the production of railroad ties for 60-centimeter, narrow-gauge tracks. One construction enterprise has converted to the mass production of railroad ties for narrow-gauge tracks, showing initiative in the right direction.

In the case of both kinds of railroad ties, experiment must be conducted to find the best way of embedding the rails. There are other possibilities for the use of prefabricated products in railroad construction, such as reinforced concrete telegraph poles, protective layers for railroad embankments, coverings for cable cases at grade crossing, signal posts, etc.

Prefabrication in Sewage Construction

This is the field in which prefabrication may be introduced to its fullest extent, partly because prefabrication is in a primitive stage, and partly because the Five-Year Plan and the 10-year water conservation plan offer almost limitless opportunities.

Mass production of concrete drainage pipes should be stressed. Before nationalization, concrete pipes were not properly standardized. The advantages of standardization must be utilized to a greater degree.

Because of its special character, subsurface construction is developing mobile prefabricating plants, at the construction site and at the gravel pits. Thereby, the building time as well as the production cost is reduced, and the same equipment may be used for continuous production. In a figurative sense, the velocity of circulation of money is increased.

Concrete pipes are still produced according to the old system in Hungary; that is, the concrete is pressed between the iron molds by hand. Abroad, presses and centrifugal equipment are used in the production of concrete pipes. It is perhaps in this field that Hungary is most underdeveloped.

Prefabrication could also be organized better in the production of reinforced concrete telephone poles, guardrail posts, lock blocks for dikes, and sewage-pipe coverings.

Village wells belong to this category also. The wells require standardized rings and heads. These could be produced partly on the spot by mobile equipment or in a centrally located plant.

It may be seen from the above that in the field of sewage construction prefabrication is dependent upon standardization. Here, it cannot be stated definitely whether mobile or stationary plants should be used. The choice is determined largely by local needs.

In the case of pipe manufacture, stationary plants are desirable if there is a large local demand; otherwise, mobile plants are more economical. In case of a stationary plant, it is important that the process be continuous and that transportation be reduced to the minimum. This may be achieved through the mechanization of loading.

Prefabrication must be so organized that the process can be carried out in winter as well. Quality must also be kept in mind. It is essential, therefore, that the plants be equipped with laboratories for strict quality control. The results of experiments must be accessible to all, and it is advisable, therefore, that the plants be placed under the supervision of the Building Research Institute.

It would be economical to organize training courses in the manufacture of quality concrete at the plants for professional and manual workers. We are definitely behind in concrete production methods, which should be given more attention by government agencies.

Prefabrication in Bridge Construction

Prefabrication attained its peak in this activity during 1950, and it may be said that the experimental stage has been passed. This applies not only to prefabrication, but to prestressed prefabricated elements also.

In bridge construction, the question of prefabrication includes all elements. These comprise piles, bridgehead floors, and supporting beams for bridges of less than 20 meters. The main supports may be prestressed at a central plant. For example, in building the Perej bridge in northern Hungary, the main supports, measuring 17 meters in length, and weighing 85 tons, were set up by means of railroad crane cars without scaffolding.

Bridgeheads which require a large quantity of concrete may also be prefabricated. To save wood frames, the bridgeheads may be made of concrete blocks. This process saves time and reduces production costs. In addition, a very pleasing concrete surface is obtained.

Prefabrication can be introduced also in the case of bridges with small-sized approaches, provided that standardization is extended. Opportunities for prefabrication exist also in the case of bridges with large approaches.

In bridge-building, prestressing has important economic implications. An effort should, therefore, be made to establish a central prestressing plant as speedily as possible.

Prestressed concrete, as compared to one cubic meter of ordinary concrete, yields savings of 300 forints because of smaller size, 80 kilograms of iron, 0.2 cubic meters of timber, and 0.3 cubic meters of concrete. In addition, 20 work hours per cubic meter are saved in scaffolding and in laying the concrete. These savings would amount to a total of 2.5 million forints in bridgebuilding during the course of the Five-Year Plan.

Quality concrete is important in the manufacture of concrete pipes and is indispensable in bridgebuilding. A carefully sifted and continuously available supply of gravel, as well as cement of standardized and even quality, must be available, and modern methods have to be applied.

In this early stage attention must also be paid to the development of adequate labor force.

Prefabrication of Reinforced Concrete Structures

These are the various sewage structures, reinforced concrete factory buildings, machine shops and foundations, etc. In these cases, also, it is the local demand which determines the scope of prefabrication. Incentive for prefabrication depends largely on the planning authorities. Under the plans, the building enterprises should resort to prefabrication almost automatically, although the authorities must create the prerequisites for prefabrication.

The field of prefabrication in surface construction is very large. Prefabricated prestressing has especially important implications in the case of flooring, posts, door and window frames, but a detailed discussion of these is beyond the scope of this article.

At present, 5.4 percent of all reinforced concrete structures are prefabricated, and this ratio will have to be raised to at least 16 percent in the course of the Five-Year Plan. This percentage is based on the value of the output.

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